EVALUATION OF USEFULNESS OF SKYLAB EREP S-190 AND S-192

IMAGERY IN MULTISTAGE FOREST SURVEYS

EREP Investigation #473

Period Covered: July 1, 1974 to February 28, 1975

Contract Number: NAS 9-13289
EarthSat Number: G-091

Principal Investigations Management Office
Lyndon B. Johnson Space Center

Technical Monitor: Mr. Clayton Forbes

Principal Investigator:

Philip G. Langley
Earth Satellite Corporation

Progress Report

EVALUATION OF USEFULNESS OF SKYLAB EREP S-190 AND S-192

IMAGERY IN MULTISTAGE FOREST SURVEYS

OVERALL STATUS

Since the last report, new S-190 and S-192 data from Skylab-III
.have been received. Coverage of our test area in Trinity County, California,
was obtained August 11 and September 11, 1974. For purposes of interpreting
forest vegetation, the data contains good S-190 color and color IR imagery
on both occasions. In addition, we have received good S-190B color coverage
from the pass of September 11. S-190A black-and-white negatives were also
received for both overflights, but these have not yet been evaluated for
forest interpretation purposes. S-192 data tapes are in hand for the June 3
pass of Skylab II and the September 11 pass of Skylab III. We also have
good quality S-190A data from the Skylab II pass of June 3, 1973.

TESTING OF A NEW PHOTO INTERPRETATION MODEL

A new photo interpretation model, based on S-190A color IR imagery
and human interpreters, was tried on 34 primary sampling units, one square
mile in size. A regression model was used in which the dependent variable
was the average volume of timber per acre over sample units. The independent
variables were: (1) the proportions of land area reflecting each of
three levels of IR color responses; bright red, dark red, and bluish, and
(2) spatial variability values for each of the three colors. The latter
three variables were designed to reflect degrees of mottling within the
three basic colors. The descriptors used were: (1) high homogeneity (or
uniform), (2) moderately homogeneous (or slightly mottled), and (3) non-
homogeneous (or highly mottled and scattered). The simple correlation

1

coefficients between these variables and timber volume were:

Variable	R
highly homogeneous	.75
moderately homogeneous	.43
non-homogeneous	.65

It remains to determine the significance of the spatial variables, how they might be improved and how they might be optimally utilized in a more comprehensive human interpretation model.

PROSPECTIVE PLANS FOR COMPLETION OF STUDY

With the amount of funding remaining for this investigation, we can pursue one of two possible courses:

Option I: We have made good progress toward formulating human interpretation models for S190-A imagery obtained on one occasion over the test site. This type of imagery has been shown to be superior to ERTS MSS imagery for increasing the precision of forest inventories using human interpreters (see "Special Report--Comparison of Results from Manual Photointerpretation of Skylab II S-190A and ERTS-A Images," June 19, 1974).

However, it remains to finalize a "best" model for use in this application and to test the finalized model on the entire population of primary sample units occurring in the test area for which we have timber volume estimates. These estimates were obtained from a previous inventory for the Southern Pacific Land Company. From this test it would be possible to make a total volume estimate for the entire area and to finally evaluate the gain in precision that could be expected when incorporating S-190A and -190B imagery into multistage forest surveys of this type.

2

Since we now have good quality S-190A imagery from three passes, spaced across the optimum foliage development period of the year, it would be highly significant to incorporate interpretations from all of these coverages into a comprehensive model in an effort to produce a best human interpretation model possible with this type of imagery.

In addition to the above, we can print out the S-192 tapes of the area and attempt to isolate a subsample of primary units. Then, the S-192 data for the best bands would be copied out by hand and incorporated with the data from the S-190 sensor. If successful, we will be able to evaluate the best combination of S-190 and S-192 data for use in multistage surveys.

This option is the one the Principal Investigator prefers to pursue. New ground will have been broken and the chance for significant result will be high.

Option II: Pursue a thorough digital analysis of the S-192 data tapes and test the digital interpretive model in our multistage design. As reported earlier, the computer firm from which we rent 1108 cpu time discontinued support of their EXEC II processor in January. Therefore, to do any in-depth analysis of the S-192 data tapes, we would have to convert all of our digital interpretation model programs to the EXEC VIII system. We estimate the cost of this conversion to be about $3,000 if done by a consultant and we would incur another three to four week delay.

In addition, our experience with the ERTS tapes showed that the time, effort, and costs involved in doing a thorough digital analysis for the purposes of our multistage investigation were extremely high. We anticipate

3

that the costs of a similar analysis of S-192 data would be even higher. This is due largely to the greater number of channels that would have to be screened and tested to obtain a "best" interpretive model.

In view of the amount of time and funding remaining for this investigation, we do not feel that we can realistically complete an analysis of this type and come up with the most significant results. On the other hand, the possibilities are excellent under Option I above, we feel. Therefore, we prefer to pursue the course outlined under Option I above and produce the best results possible by interpreting the three coverages of S-190A data, one coverage of S-190B data, and gain an impression (with some analysis) of the usefulness of S-192 data in multistage forest surveys of the type being investigated.